

## Air pollution and climate change

IGBP'S International Global Atmospheric Chemistry project (IGAC) has been organising a series of workshops to understand the interconnected challenges of air pollution and climate change. Earlier workshops were held as part of an IGBP synthesis topic. The most recent workshop (held in Boulder, Colorado, in November 2013) built on that foundation. It brought together 32 participants from 15 countries representing the natural and social sciences, the policy community and the private sector. The aim was to begin developing a

strategic framework that will guide integrated policy and research on air pollution and climate change.

## New initiative to focus on human-dominated environments

HUMANS have arguably left their mark on all of Earth's ecosystems, even those considered to be relatively pristine. The ubiquity of farms, pastures, orchards and urban areas testifies to how thoroughly humans have shaped and continue to shape the planet's land surface. Three IGBP core projects have now teamed up to understand the interrelationships between

such managed ecosystems, the societies that manage them and Earth's climate. The new initiative – Interactions among Managed Ecosystems, Climate, and Societies (IMECS) – will be coordinated by the Integrated Land Ecosystem–Atmosphere Processes Study (iLEAPS), the Global Land Project (GLP) and the Analysis, Integration and Modelling of the Earth System (AIMES) project. The initiative, which arose from an IGBP-sponsored synthesis on the links between land-use/land-cover changes and climate, will seek to bring together research communities that study land from both physical and socioeconomic perspectives.

[www.ileaps.org/?q=node/51](http://www.ileaps.org/?q=node/51)

## Tipping points in the limelight

A NEW television series examines the critical thresholds that, if exceeded, might dramatically alter Earth's climate and tip the climate system past a point of no return. Hosted by climate journalist and adventurer Bernice Notenboom, the series is entitled *The Tipping Points: 6 places on Earth where climate's changed*. It explores the interconnectedness of the various elements that make up our climate system. Examples include the Amazon rainforest and the Greenland ice sheet. The series has aired on Dutch and US television.

The television series draws on research led by Tim Lenton, who is a member of the Scientific Steering Committee of IGBP's Analysis, Integration and Modelling of the Earth System (AIMES) project. He and AIMES Chair Peter Cox served as scientific consultants for the series, with Tim Lenton featuring most prominently in the episode on Greenland and Peter Cox in the episode on the Amazon rainforest.

[www.thetippingpoints.com/](http://www.thetippingpoints.com/)

## TWO NEW SYNTHESIS BOOKS PUBLISHED

A RECENTLY published open-access book synthesises research coordinated by the Surface Ocean–Lower Atmosphere Study (SOLAS), co-sponsored by IGBP. The book emerged as an outcome of Action 735 of the office of European Coordination in the field of Scientific and Technical Research. The synthesis, initiated in 2006, entailed the development of global air–sea flux datasets of gases and aerosols. It involved more than 300 scientists mainly from Europe but also from other parts of the world. The SOLAS International Project Office played a key role in coordinating this synthesis, led by Peter Liss, former Chair of SOLAS and IGBP, and Martin Johnson.

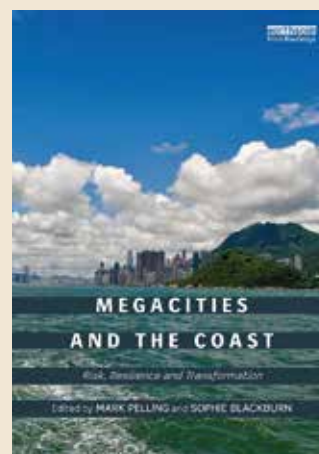
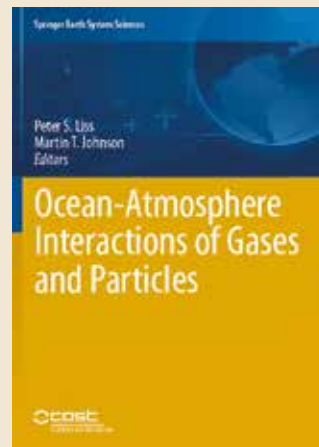
The dynamic interactions between megacities and coastal zones are the focus of the second book, which arose from a synthesis

initiated in 2010 by IGBP and its Land–Ocean Interactions in the Coastal Zone (LOICZ) project. The book, which received contributions from over 60 authors from across the world, captures current knowledge on both the human and physical dimensions of coastal megacities. It draws attention to social and environmental risks arising from megacity development while also highlighting the potential solutions that can emerge from such cities.

Liss P S and Johnson M T (eds) (2013) *Ocean–Atmosphere Interactions of Gases and Particles*. Springer, Heidelberg. <http://link.springer.com/book/10.1007/978-3-642-25643-1>

Pelling M and Blackburn S (eds) (2013) *Megacities and the Coast: Risk, resilience and transformation*. Routledge, London and New York.

See Feature page 8.





## Exploring the Anthropocene

THE ANTHROPOCENE captures a time slice in human history when the confluence of globalisation, urbanisation, technological developments and resource consumption is conspiring to make humanity a geological force. This concept was the focus of a recent (January 2014) workshop co-organised by the International Geosphere-Biosphere Programme (IGBP) and the International Human Dimensions Programme on Global Environmental Change (IHDP). The workshop – one of the pillars of IGBP’s overarching synthesis – brought together 30 or so experts from diverse disciplines in the natural and social sciences on the campus of the University of Maryland.

The workshop took place over three days and included both plenary sessions as well as breakout group discussions. Three aspects were looked at, each of which is being developed into an independent paper: 1) Conceptual frameworks; 2) Methodological issues (including modelling and assessment); and 3) Implications for research and policy. The aim was to evaluate the Anthropocene from various perspectives including geological/biophysical, anthropological, historical and economic. A series of papers are forthcoming.

## Future Earth website and blog

The new Future Earth website is now live and features links to the Future Earth blog, upcoming events and how to get involved in the new initiative. [www.futureearth.info/](http://www.futureearth.info/)

## Cross-project collaboration and setting the research agenda

A three-day Future Earth meeting in January brought together many of the projects and programmes that will eventually form the backbone of the new initiative. The meeting focused on identifying Future Earth’s strategic research priorities as well as ways to encourage cross-project collaboration. For example, a suite of “Fast-Track Initiatives” (FTIs) – short-term research or engagement activities undertaken by two or more core projects – modelled on the highly successful IGBP FTIs during the past decade. Future Earth will fund possibly eight to ten such initiatives, each with a budget of up to \$100,000. The third day of the meeting, organised by IGBP, focused on the practical needs of projects across the global-environmental-change programmes as they move towards Future Earth.



## Future Earth engagement committee

Future Earth’s interim Engagement Committee met in person for the first time in January at Columbia University, New York. The committee, a novel development from previous global-environmental-change programmes, will oversee the strategy for involving stakeholders in Future Earth – from research co-design to dissemination.

The committee is chaired by Robert Watson who is Vice-Chair of the Intergovernmental Platform on Biodiversity and Ecosystem Services and former chair of the Intergovernmental Panel on Climate Change and includes James Griffiths from the World Business Council for Sustainable Development, Amy Luers from the Skoll Global Threats Fund, Andrew Revkin from the *New York Times* and Guido Schmidt Traub from the UN Sustainable Development Solutions Network.



Robert Watson

## No pause in extremes

THE INCREASE in global mean temperature seems to have slowed down during the past decade and a half despite continuously rising atmospheric carbon-dioxide concentrations. But the world’s landmasses have had no respite from extremely hot days: the number of such days per year has continued to rise, according to a recent commentary published in *Nature Climate Change*.

The apparent pause in the increase of global mean temperature received intense media scrutiny last year. Several

reasons – internal climate variability or heat uptake by the lower ocean, for example – were offered as possible explanations. Sonia Seneviratne and colleagues point out that distinct temperature trends may nevertheless be discernible when different regions and seasons are considered.

Their analysis focused on warm extremes over land as these are the most relevant when considering the impact of climate change. They found that the area of land that experienced extremely hot days increased since 1979. The frequency of the hottest days

has increased continuously and there was no slowdown during the past couple of decades.

The increasing frequency of the hottest days over land hints at positive feedbacks such as those arising from soil moisture deficits. Such feedbacks mean that the trends in temperature extremes might diverge from those in global mean temperature. The authors thus caution against overinterpreting the trend in global mean temperature as an indicator of the impacts of climate change.

Seneviratne S *et al.* (2014) *Nature Climate Change* 4: 161-163, doi:10.1038/nclimate2145.

## IPCC report highlights impacts of climate change

THE RECENT Intergovernmental Panel on Climate Change Working Group II report, which focuses on impacts, adaptation and vulnerability, is all about risk management. In the 44-page summary for policymakers, published in March, the word “risk” appears 181 times. Compare this with IPCC’s 2007 report, which used the word “risk” just 41 times, and you get a feel for the new emphasis.

A reader of *Global Change* magazine will not be surprised by any of the conclusions drawn by the report’s authors. All regions of the planet will be affected. There will be economic, social and environmental impacts. Food security is at risk. Coastal cities

are at risk. Marine ecosystems are at risk. The list goes on.

Writing on the Real Climate blog, Wolfgang Cramer, an author of the summary, pointed out that scenarios in which global mean temperature reaches 4°C or more above preindustrial conditions – a situation not unlikely according to the Working Group I report – will likely result in catastrophic impacts on most aspects of human life on the planet.

*The Economist* came to a different conclusion: “the right policies frequently try to lessen the burden [of climate change] – to adapt to change, rather than attempting to stop it.”

The IPCC’s assessment of options for mitigating climate change – the Working Group III summary for policymakers – was published several weeks

later. The IPCC intends the recommendations of Working Groups II and III to be viewed as complementary.

The Working Group III authors estimate that reaching 450ppm CO<sub>2</sub> equivalent entails “consumption losses” of about 1.7% by 2030. This grows to about 3.4% by 2050 and about 4.8% by 2100.

All this translates to “a reduction in consumption growth over the 21st century by about 0.06% per year”. Brigitte Knopf, Deputy Head of Sustainable Solutions at the Potsdam Institute for Climate Impact Research, wrote on the Real Climate blog, “This means that instead of a growth rate of about 2% per year, we would see a growth rate of 1.94% per year.”

Many IGBP scientists contributed to the IPCC report.

## IGBP OFFICERS’ MEETING

**5-7 November, Gabarone and Maun, Botswana**

IGBP held its 2013 Officers’ meeting in Botswana at the invitation of IGBP Vice-Chair Pauline Dube and the Botswana Global Change Committee. The committee organised a stimulating knowledge-exchange symposium that attracted scientists, business leaders and policymakers.

The Officers’ meeting focused on IGBP’s final syntheses including an event in 2015 as part of the US AGU conference in San Francisco to mark the achievements of IGBP, the transition to Future Earth, and our other activities.

In addition to the IGBP Officers’ meeting, there were many events organised by the Botswana Global Change Committee. After two days in the capital, Gabarone, the meeting moved to Maun on the edge of the famous Okavango Delta. Here Officers met the Acting Paramount Chief of Batawana Kgosi Kealitile Moremi, Dikgosa. This was the first time a group of international scientists had met

with tribal elders at a *kgotla* – a public meeting. Village leaders came from a 50-kilometre radius and gathered in a traditional thatched building. IGBP Officers engaged in a lively and open discussion on global change and how it impacts the delta through tourism and mining.

IGBP Officers then travelled to the Okavango Research Institute’s research base deep in the delta. Institute researcher Dr Mike Murray-Hudson’s formidable knowledge of the geology, flora and fauna of the inland delta gave IGBP’s Officers a deeper appreciation and understanding of this region and the changes it is undergoing.



IGBP Executive Director Sybil Seitzinger with the Acting Paramount Chief of Batawana Kgosi Kealitile Moremi.

Wendy Broadgate

## EVENTS

### 2014

#### May

**5-9.** 46th International Liege Colloquium on Ocean Dynamics. Liège, Belgium.

**12-16.** Adaptation Futures 2014: Third International Climate Change Conference. Fortaleza/Ceará, Brazil.

**12-16.** 4th iLEAPS Science Conference 2014. Nanjing, China.

**19-20.** Sustainability in the Water-Energy-Food Nexus. Bonn, Germany.

#### June

**16-18.** SOLAS SSC meeting. Rehovot, Israel.

**19.** SOLAS Symposium. Rehovot, Israel.

**23-27.** IMBER Open Science Conference. Bergen, Norway.

**27-28.** IMBER SSC meeting. Bergen, Norway.

#### August

**4-9.** IMBER ClimEco4 Summer School. Shanghai, China.

#### September

**22-26.** IGAC Chemistry in a Changing World conference. Natal, Brazil.

**24-26.** Deltas in Times of Climate Change II. Rotterdam, The Netherlands.

#### October

**22-24.** Global Challenges: Achieving Sustainability. Copenhagen, Denmark.

**28-29.** AIMESS SSC meeting. Hamburg, Germany.

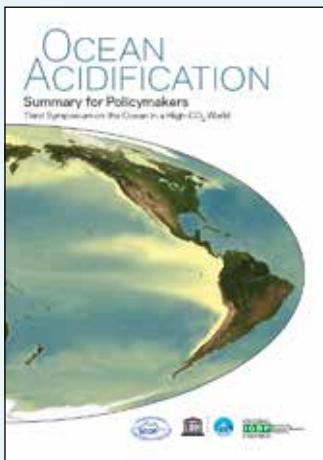
#### November

**6-8.** 2nd International UGEC Conference: Urban Transitions and Transformations: Science, synthesis and policy. Taipei, Taiwan.

**14-22.** Anthropocene Campus. Berlin, Germany.



# NEW OCEAN ACIDIFICATION REPORT PUBLISHED



IGBP and partners launched the Ocean Acidification Summary for Policymakers at the UN climate negotiations in Warsaw, November 2013. The summary, based on findings from the world's largest gathering of experts on ocean acidification – the 2012 Ocean in a High-CO<sub>2</sub> World symposium – attracted headlines in *The Economist*, the BBC and *Washington Post*.

Experts conclude that marine ecosystems and biodiversity are likely to change as a result of ocean acidification, with far-reaching consequences for society. Based on projections, the acidity of the world's oceans may increase by around 170% by the end of the century bringing potentially significant economic losses. People who rely on the oceans' ecosystem services – often in developing countries – are especially vulnerable.

Author and symposium chair Ulf Riebesell of GEOMAR Helmholtz Centre for Ocean Research in Kiel said: "What we can

now say with high levels of confidence about ocean acidification sends a clear message. Globally we have to be prepared for significant economic and ecosystem-service losses. But we also know that reducing the rate of carbon-dioxide emissions will slow acidification."

One outcome emphasised by experts is that if society continues on the current high emissions trajectory, cold-water coral reefs, located in the deep sea, may be unsustainable and tropical-coral-reef erosion is likely to outpace reef building this century. However, significant emissions reductions to meet the two-degree target by 2100 could ensure that half of surface waters presently occupied by tropical coral reefs would remain favourable for their growth.

The summary makes 21 statements about ocean acidification with a range of confidence levels from "very high" to "low".

## THESE INCLUDE: Very high confidence

Ocean acidification is caused by carbon-dioxide emissions from human activity to the atmosphere that end up in the ocean.

The capacity of the ocean to act as a carbon sink decreases as it acidifies.

Reducing carbon-dioxide emissions will slow the progress of ocean acidification.

Anthropogenic ocean acidification is currently in progress and is measurable.

The legacy of historical fossil-fuel emissions on ocean acidification will be felt for centuries.

## High confidence

If carbon-dioxide emissions continue on the current trajectory, coral-reef erosion is likely to outpace reef building some time this century.

Cold-water coral communities are at risk and may be unsustainable.

Molluscs, such as mussels, oysters and pteropods, are one

of the groups most sensitive to ocean acidification.

The varied responses of species to ocean acidification and other stressors are likely to lead to changes in marine ecosystems, but the extent of the impact is difficult to predict.

Multiple stressors compound the effects of ocean acidification.

## Medium confidence

Negative socio-economic impacts on coral reefs are expected, but the scale of the costs is uncertain.

Declines in shellfisheries will lead to economic losses, but the extent of the losses is uncertain.

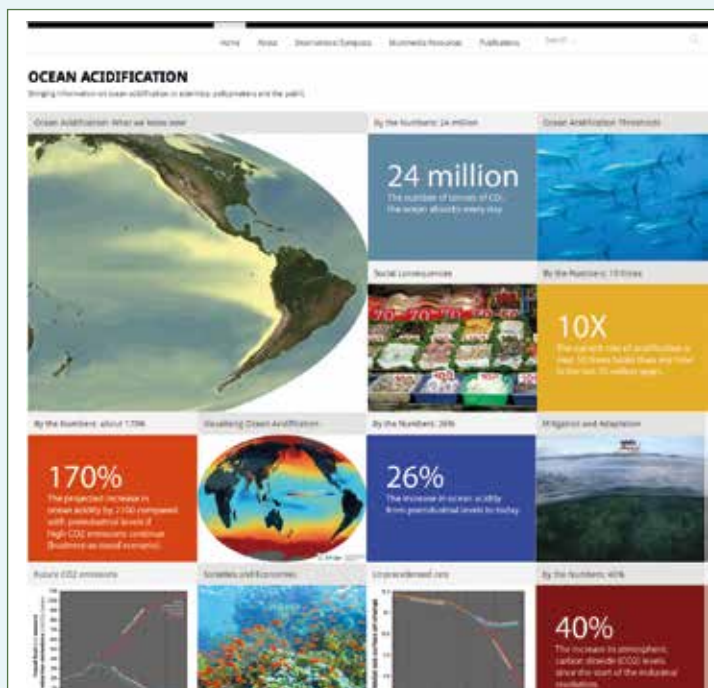
Ocean acidification may have some direct effects on fish behaviour and physiology.

The shells of marine snails known as pteropods, an important link in the marine food web, are already dissolving.

The summary for policymakers is sponsored by the International Geosphere-Biosphere Programme, the Scientific Committee on Oceanic Research (SCOR) and the Intergovernmental Oceanographic Commission (IOC) of UNESCO.

IGBP, in collaboration with SCOR, IOC-UNESCO and the Ocean Acidification International Coordination Centre of the International Atomic Energy Agency, has recently launched a new website on ocean acidification for scientists, policymakers and the public.

The report, supporting materials and graphics are available from [www.ocean-acidification.net](http://www.ocean-acidification.net).



The new Ocean Acidification website, [www.ocean-acidification.net](http://www.ocean-acidification.net).